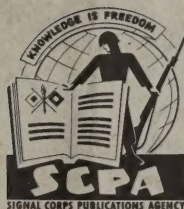


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**INSTRUCTION SHEETS**  
**for**  
**POWER SUPPLY GROUP OA-565/MPM-24**  
**OPERATION**



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**MANUFACTURED BY**  
**SPERRY GYROSCOPE COMPANY**  
**ORDER NO. 3550-PH-52-31**  
**1 MAY 1954**

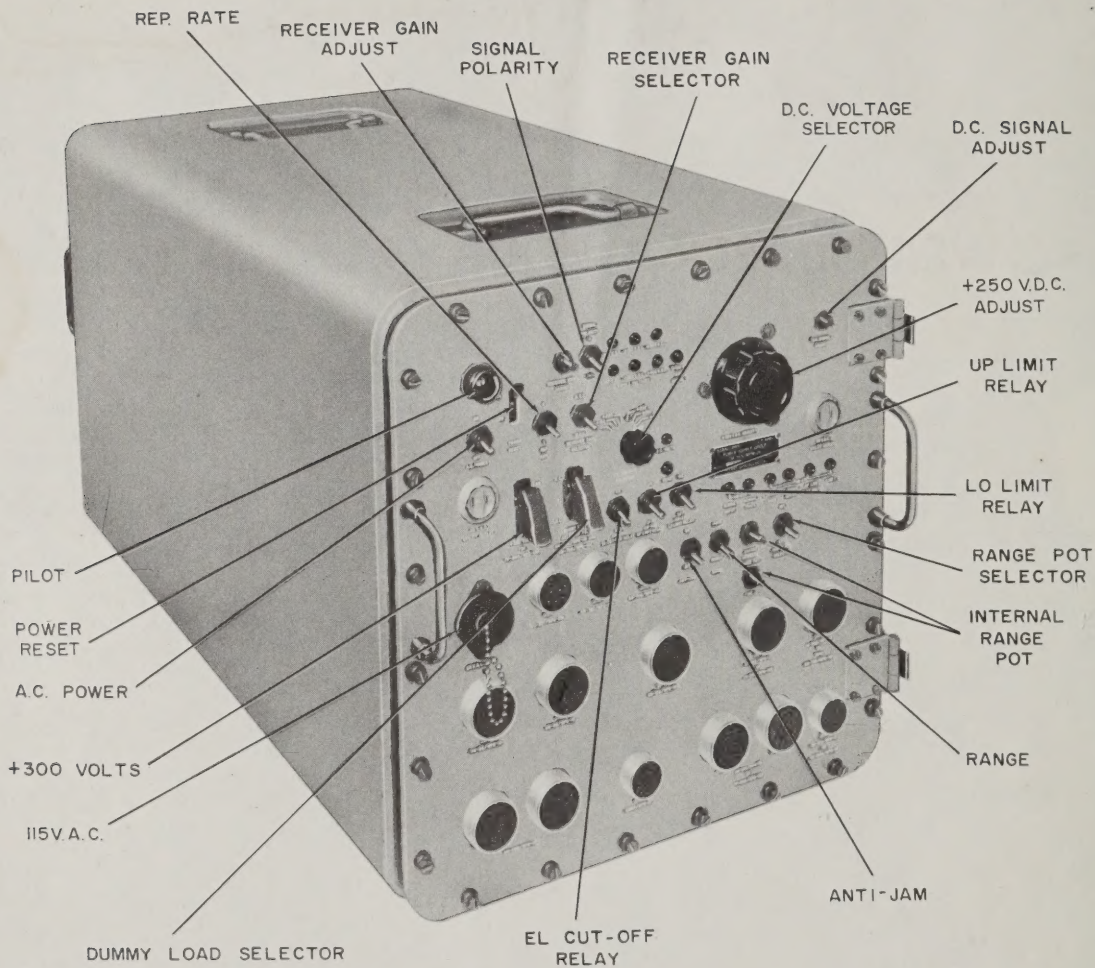


Figure 1. Power Supply Group OA-565/MPM-24.



## Section I

# OPERATION

### 1. DESCRIPTION

a. Power Supply Group OA-565/MPM-24 is issued when it becomes necessary to test or repair certain electrical components of Radar Set AN/MPQ-10 and/or AN/MPQ-10A. It consists of a dustproof metal cabinet (fig. 1) which contains two Positive Power Supplies PP-745/MPQ-10, a Negative Power Supply PP-746/MPQ-10, a Voltage Regulator CN-167/MPQ-10 (par. 6 and fig. 4), a filament assembly chassis, and an amplifier loading chassis (par. 6 and fig. 5). All operating jacks, receptacles, and controls are located on the front panel. The operation of the three power supplies and the voltage regulator is covered in the Instruction Book for Radar Set AN/MPQ-10 Field Maintenance

b. Seven output cables (fig. 3) of three different types are supplied which provide for all the necessary connections between the test equipment and the radar set components.

c. A power cable connects the test equipment to the ac power source.

d. An intake fan circulates filtered air within the cabinet.

### 2. APPLICATION

a. Power Supply Group OA-565/MPM-24 supplies the voltages required to operate most of the removable components of the radar set. Dynamic checks of the individual units require the use of additional external test instruments.

b. The power supply group also furnishes a dc range signal, has manual controls for the receiver gain and pulse repetition rate, provides for the energizing of most essential relays, and substitutes resistances in place of the motor and generator servo field windings.

### 3. OPERATING CONTROLS

a. The following table lists the controls of the control panel (fig. 1) and indicates the function of each:

Control	Function
A.C. POWER switch (S107)	In ON position, supplies single phase ac power to power supply group.
AC POWER pilot lamp (E103)	Lights when A.C. POWER switch is placed at ON.
POWER RESET (K101)	Circuit breaker trips when short circuit or overload occurs. To reset, place at ON.
RECEIVER GAIN SELECTOR (S102)	In A.G.C. position, provides for automatic control of receiver gain from synchronizer unit 3; in M.G.C. position, makes possible local control of receiver gain by means of RECEIVER GAIN ADJUST.
RECEIVER GAIN ADJUST (R101)	Permits manual adjustment of receiver gain when RECEIVER GAIN SELECTOR is in M.G.C. position.
REP. RATE (S101)	Normally in position 1; provides a repetition rate of about 1,100 pulses per second. In position 2, provides a repetition rate of 1,000 pulses per second.

Control	Function
D.C. VOLTAGE SELECTOR (S106)	A 6-position wafer switch that connects the voltages indicated by the panel markings to adjacent jacks, D.C. VOLTS and GRND. Used with external voltmeter to measure various power supply and voltage regulator output voltages.
ANTI-JAM switch (S104)	Normally in OFF position. In ON position energizes relay which connects circuits within receiver that alleviate effects of jamming and clutter.
RANGE switch (S103)	In AUTO position, relay within range servo amplifier is energized. In MANUAL position, excitation is removed from relay.
RANGE POT SELECTOR (S105)	When placed in EXT. position, provides for application of an external dc range signal to synchronizer unit 2. In INT. position, supplies internal range signal to synchronizer unit 2.
INTERNAL RANGE POT COARSE (R102) FINE (R106)	Adjusts amplitude of the signal applied to synchronizer unit 2 when RANGE POT SELECTOR is in INT. position. Has coarse and fine controls.
+300 VOLTS switch (S109)	Equipped with a guard. Normally in OFF position. In ON position, places +300 volts on pin C of receptacle J1601 for testing of 400-cycle power supply.
DUMMY LOAD SELECTOR (S108)	Equipped with a guard. Normally set at D.C. Places a dummy load upon the range servo amplifier. In D.C. position, tests Electronic Control Amplifier AM-759/MPQ-10A. In A.C. position, tests Electronic Control Amplifier AM-602/MPQ-10.
+250 V.D.C. ADJUST (T101)	Used to adjust the output voltage of the unregulated +250-volt positive power supply.
D.C. SIGNAL ADJUST (R122)	Adjusts dc output at J112 0-150V DC SIGNAL jack.
EL CUT-OFF RELAY switch (S110)	Simulates the action of relay K511 on servo control chassis. Normally set at OFF to ground cathodes of elevation servo power amplifiers V1518 and V1519. When set at ON, ground connection is removed from cathodes.
UP LIMIT RELAY switch (S111)	Simulates action of elevation upper limit switch S1401 on elevation servo motor. Switch is normally set at OFF. When at ON, relay K1611 is energized.
LO LIMIT RELAY switch (S112)	Simulates action of elevation lower limit switch S1402 on elevation servo motor. Switch is normally set at OFF. When at ON, relay K1610 is energized.
SIGNAL POLARITY switch (S113)	Reverses polarity at 0-150V DC SIGNAL jack J112.



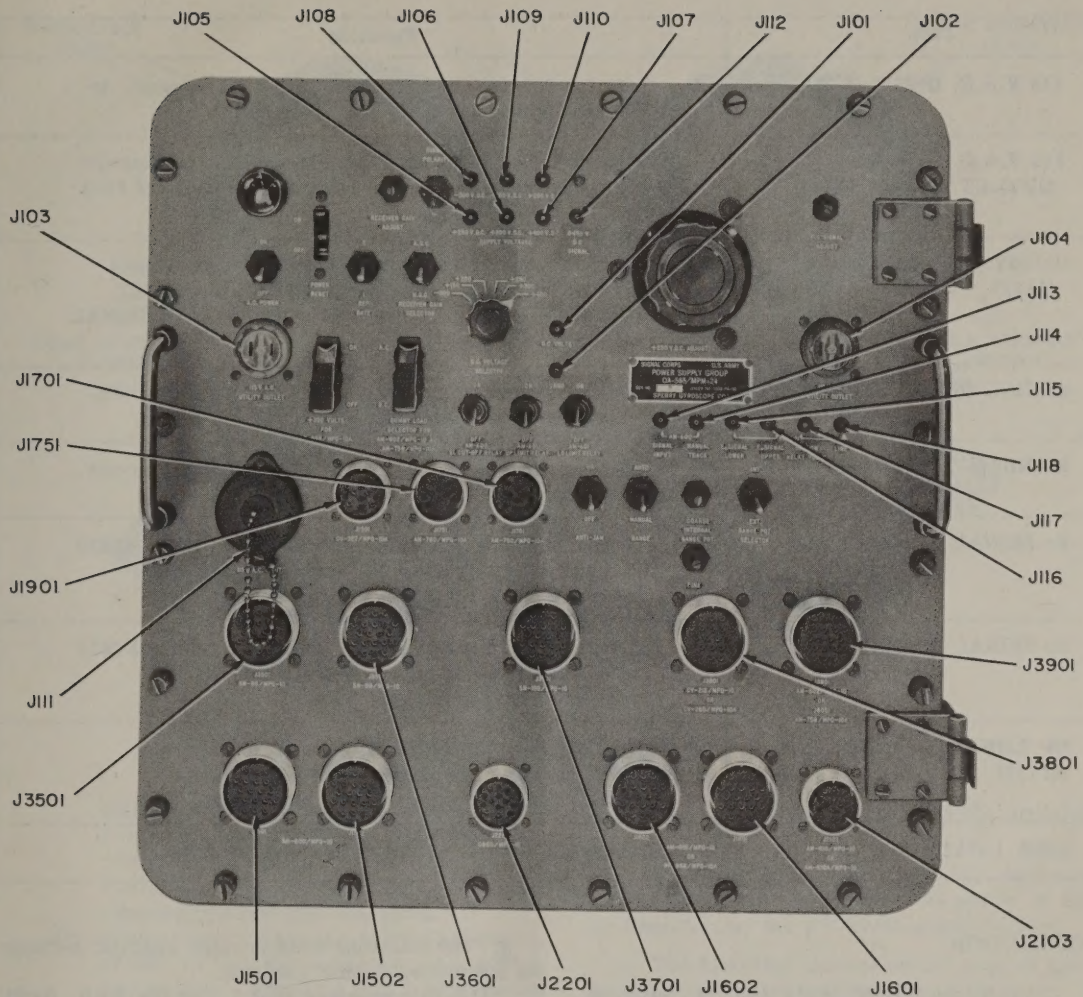


Figure 2. Control panel, jacks and receptacles.

b. The following table lists the receptacles and jacks (with the exception of those to which com-

ponents under test are connected) of the control panel (fig. 2) and indicates the function of each:

Jack	Function
SUPPLY VOLTAGES (J105, J106, J107, J108, J109, J110)	Supply indicated voltages for testing of inaccessible circuits. Are not dependent upon setting of D.C. VOLTAGE SELECTOR.
D.C. VOLTS (J101)	Jack for connection of external voltmeter to measure voltage indicated by D.C. VOLTAGE SELECTOR.
GRND. (J102)	A common ground for D.C. VOLTS and SUPPLY VOLTAGES.



Jack	Function
115 V.A.C. INPUT (J111)	Input for 115-volt, single-phase, 60-cps ac power. Is covered with a protector cap.
115 V.A.C. UTILITY OUTLET (J103, J104)	Supplies 115-volt ac power for external miscellaneous test equipment. Maximum combined capacity of J103 and J104 is 1725 watts.
0-150V. D.C. SIGNAL (J112)	Provides a variable, positive or negative dc voltage for test purposes. Polarity is changed by SIGNAL POLARITY switch. Voltage is varied by D.C. SIGNAL ADJUST.
SIGNAL INPUT (J113)	Provides access to grid of V1501 of azimuth circuits of antenna servo amplifier.
MANUAL TRACK (J114)	Provides access to grid of V1511 of elevation circuits of antenna servo amplifier.
Eo SIGNAL LOWER (J115)	Provides access to contacts of lower limit relay K1610 on 400-cycle power supply chassis and altitude computer servo amplifier chassis.
Eo SIGNAL UPPER (J116)	Provides access to contacts of upper limit relay K1611 on 400-cycle power supply chassis and altitude computer servo amplifier chassis.
UP LOW RELAY VOLTS (J117)	Provides access to contacts of limit release relay K1612 on 400-cycle power supply chassis and altitude computer servo amplifier chassis.
LINE 1 (J118)	Connection to L <sub>1</sub> of ac supply for test purposes.

#### 4. OPERATION

a. Connect the power cable (fig. 3) supplying 115-volt, single-phase, 60-cycle ac to the 115 V.A.C. INPUT jack, J111.

b. Connect the chassis under test to its associated receptacle on the control panel (fig. 2) by use of the correct cable.

c. Place the D.C. VOLTAGE SELECTOR at the +250 position.

d. Connect an external voltmeter between D.C. VOLTS (J101) and GRND (J102).

e. Set the A.C. POWER switch at ON.

f. Rotate the +250 V.D.C. ADJUST knob until the voltmeter indicates exactly +250 volts dc. The other supply voltages are electronically regulated and do not require adjustment.

**CAUTION:** Steps b. through f. must be performed whenever a different component is connected to the test equipment and the A.C. POWER switch must be set at OFF before connecting or disconnecting cables from the control panel.

g. The following units require specific settings of the test equipment controls.

- (1) Synchronizer unit 1. Set the REP. RATE switch to provide either 1,100 (position 1) or 1,000 (position 2) pulses per second as required.
- (2) Synchronizer unit 2. Place the RANGE POT SELECTOR at INT. and adjust the INTERNAL RANGE POT for the required amplitude of range signal. When an external range signal is preferred, set the RANGE POT SELECTOR at EXT. and connect a range servo unit to J3801.
- (3) Synchronizer unit 3. Set the RECEIVER GAIN SELECTOR at M.G.C. and adjust the RECEIVER GAIN ADJUST for the desired gain. For automatic gain control, set the RECEIVER GAIN SELECTOR at A.G.C.
- (4) Range servo amplifier. Place the DUMMY LOAD SELECTOR in the A.C. position for Electronic Control Amplifier AM-602/MPQ-10. Place the DUMMY LOAD

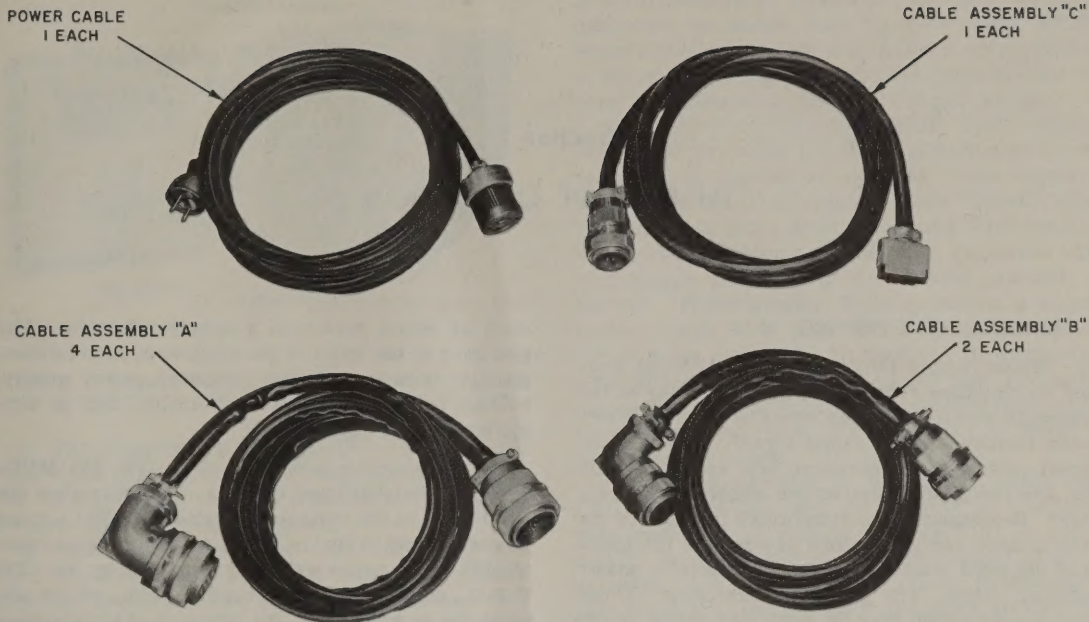


Figure 3. Cable assemblies.

SELECTOR in the D.C. position for Electronic Control Amplifier AM-759/MPQ-10A. Set the RANGE switch at AUTO to check the auto-manual relay or when simulating automatic operation.

- (5) If amplifier. Place the ANTI-JAM switch at ON to test for reduction of jamming and clutter. When the ANTI-JAM switch is set at OFF, circuits within the chassis that alleviate jamming are disconnected.
- (6) 400-cycle power supply. Set the +300 VOLTS switch at ON.
- (7) Antenna servoamplifier. Set the EL CUT-OFF RELAY switch to OFF to ground the cathodes of the elevation power amplifiers (V1518 and V1519). To cut the tubes off, set the switch to ON.
- (8) Altitude computer servo amplifier. Set the UP LIMIT RELAY and LO LIMIT RELAY switches to OFF. If it is desired to check the operation of the upper and

lower limit relays, set the switches to ON.

**CAUTION:** Both J1601 and J1602 must be connected to the control panel before power is turned on when testing the 400-cycle power supply.

h. The following chassis do not require specific settings of the test equipment controls.

- (1) Range servo unit.
- (2) RoHo amplifier.
- (3) Afc unit.
- (4) Isolation amplifier.

## 5. STOPPING

a. The following procedure is recommended for turning off the test equipment.

- (1) Set the A.C. POWER switch at OFF.
- (2) Set all the operating controls at their normal positions as specified in paragraph 3a.



## Section II

### THEORY OF OPERATION

#### 6. GENERAL FUNCTIONING

a. Power Supply Group OA-565/MPM-24 supplies the voltages required to operate many of the removable electronic components of the radar set. It also furnishes a dc range signal, provides for manual control of the receiver gain and repetition rate, and energizes most of the essential chassis relays. Resistances are substituted in place of the servo motors and generators to simulate the loading of the field windings on their respective power amplifier tubes. The general functioning of the power supply group may be explained more readily by dividing the equipment into five systems,

each of which performs a specific function. The grouping of the units of the equipment is as follows; positive power supplies, negative power supply, voltage regulator, filament assembly, and an amplifier loading chassis.

b. Two positive power supplies (PP-745/MPQ-10, figs. 4 and 10) are utilized. One furnishes the +400 volts to the voltage regulator unit. The second power supply acts in place of motor generator MG401 of the radar set. It is regulated by the +250 V.D.C. ADJUST (fig. 1), variac T101, which adjusts the ac voltage on the primary of high voltage transformer T3101.

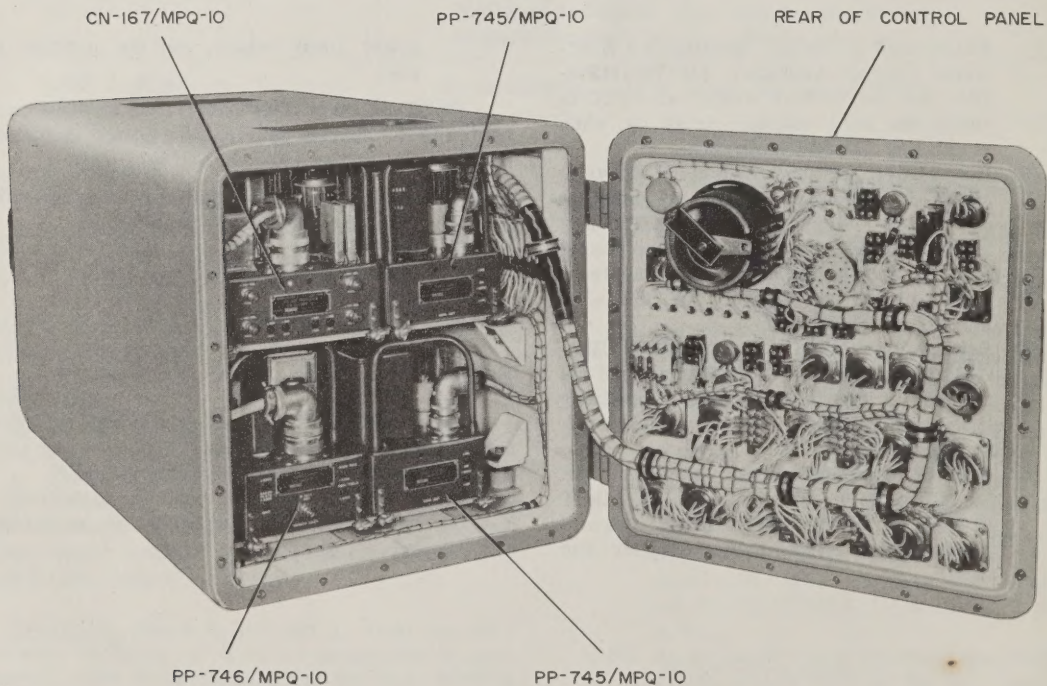


Figure 4. Power supply group, front cover open.



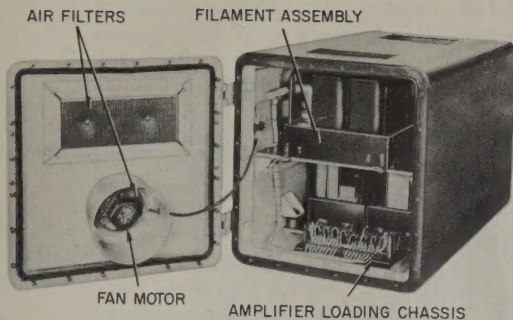


Figure 5. Power supply group, rear cover open.

c. The negative power supply (PP-746/MPQ-10, figs. 4 and 11) operates in a conventional manner and its output (-300 volts) is obtained at the various receptacles on the control panel.

d. The voltage regulator (CN-167/MPQ-10, figs. 4 and 12) receives +400 volts unregulated from one positive power supply and furnishes +300 volts regulated. Manual control of the ac input voltage to the plate transformer of the second positive power supply provides +250 volts unregulated dc to substitute for the 250-volt generator of the radar set. The +250 V.D.C. ADJUST knob must be regulated each time a chassis is tested because of variation in the loading of this positive power supply. The voltage regulator also supplies +200 and +150 volts regulated from the +250 volt input.

e. The filament assembly (figs. 5, 6, and 9) consists of four 6.3 volt filament transformers mounted on a separate chassis. The primaries are wired in parallel and the secondaries are connected individually to J201. These transformers supply all the filament current needed during the operation of the power supply group.

f. The amplifier loading chassis (figs. 5, 7, and 9) is composed of 14 resistors which approximate the loadings of the five servo motors and the two servo generators. These resistors, operating in pairs, substitute for the field windings of the respective servo motors and generators.

## 7. CIRCUIT FUNCTIONING

a. **General.** Circuit functioning of the test equipment controls and components is described below. Refer to figure 9 for a schematic diagram of the power supply group. Reference should be made to the Instruction Books for Radar Sets AN/MPQ-10 and AN/MPQ-10A for schematics of the components to be tested.

b. **Synchronizer Unit 1.** REP. RATE switch S101 controls repetition-rate relay K3521 which provides a repetition rate of either 1,100 pulses per second or 1,000 pulses per second. When S101

is set at position 2, terminal 6 of relay K3521 is connected to power lead  $L_1$  energizing K3521. Relay K3521 is inactive when S101 is set at position 1. No provision for jittering the repetition rate has been incorporated in the power supply group.

c. **Synchronizer Unit 2.** RANGE POT SELECTOR S105 provides for the application of an internal dc voltage or an external range signal to the cathode (pin 1) of pick-off diode V3604B. When S105 is set at INT., R105, R102, and R106 function as a voltage divider across the regulated +200 volt supply and control the cathode potential of V3604B. Potentiometer R102 provides a coarse control while R106 is a vernier control. An external range signal can be supplied by connecting a range servo unit to J3801 of the test equipment and setting S105 at EXT. Then synchronizer unit 2 receives a signal from the wiper arm of R3834 in the range servo unit.

d. **Synchronizer Unit 3.** RECEIVER GAIN SELECTOR S102 provides for manual or automatic gain control of the receiver. When S102 is set at A.G.C., terminal 3 of gain control relay K3721 is grounded and K3721 is energized, furnishing a path for an agc signal to the if amplifier. RECEIVER GAIN ADJUST R101 controls the gain of the receiver when S102 is set at M.G.C. R101 takes the place of the receiver gain potentiometer on the radar set control and operates in a similar manner.

e. **Range Servo Amplifier.**

- (1) RANGE switch S103 operates auto-manual relay K3911 (Electronic Control Amplifier AM-602/MPQ-10) or K6057 (Electronic Control Amplifier AM-759/MPQ-10A). When S103 is set at AUTO, terminal

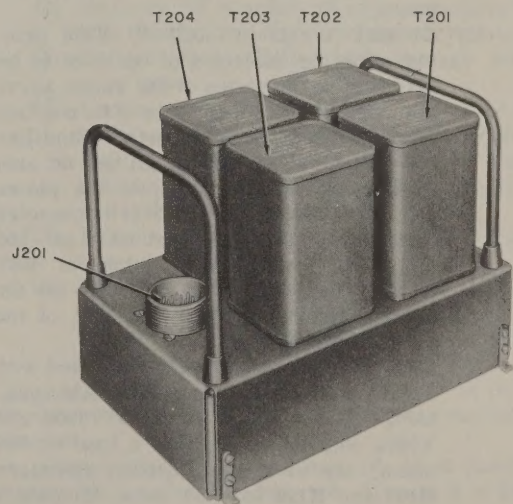


Figure 6. Filament assembly chassis.



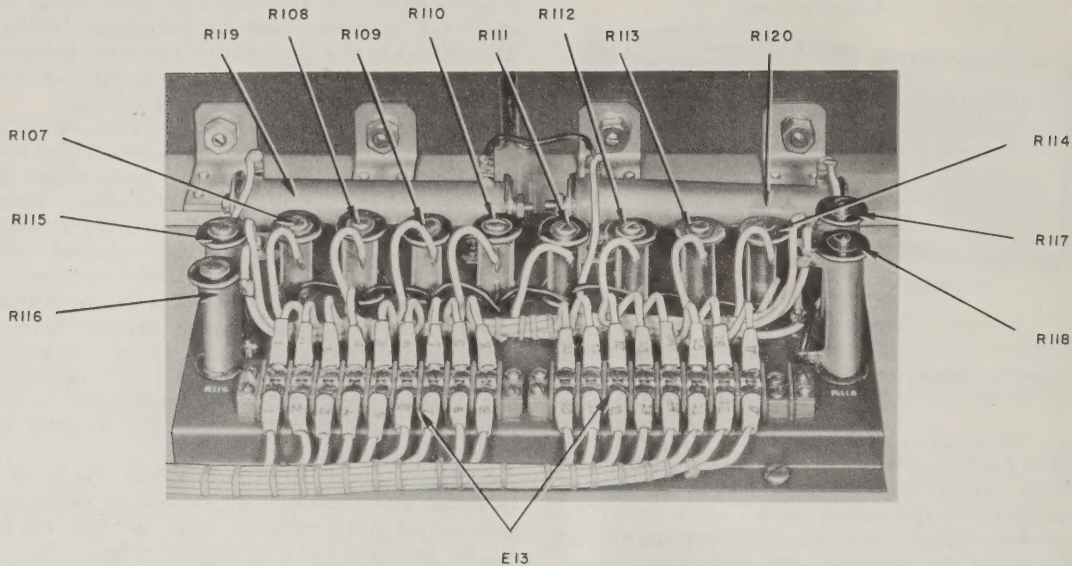


Figure 7. Amplifier loading chassis.

6 of the relay coil is connected to power lead  $L_1$ , energizing the relay and opening a path for an automatic range error signal to be fed into the range servo amplifier. The RANGE switch disconnects the power lead from the relay when it is set at MAN. RANGE switch S103 replaces RANGE switch S5502 of the radar control panel.

- (2) DUMMY LOAD SELECTOR S108 provides for the selection of the load to be placed upon the plates of the range servo power amplifier tubes. The D.C. position is used with Electronic Control Amplifier AM-759/MPQ-10A which utilizes dc amplification. In this position, the plates (pin 1) of V6054 and V6055 are connected through resistors R115 and R116 to +250 volts, representing a total load of 4000 ohms. These resistors substitute for the resistance of the field windings of the range servo motor.
- (3) The A.C. position of S108 is used with Electronic Control Amplifier AM-602/MPQ-10. The plates (pin 1) of V3904 and V3905 which already have a load of 400 ohms, are connected through resistors R109 and R110 to +250 volts, forming a total load of 640 ohms.

f. If Amplifier. ANTI-JAM switch S104 operates anti-jam relay K2111 located in the if amplifier.

In the ON position, approximately 80 volts is fed to terminal 1 of the K2111 coil closing the relay and preventing the transmission of any pulse longer than .8 microsecond through the if amplifier. Range marker relay K2121 is energized when power is applied to the if chassis.

g. 400-cycle Power Supply.

- (1) The +300 VOLTS switch S109 supplies +300 volts to the plates (pins 1 and 9) of V1653 when set at the ON position. This voltage is removed when S109 is placed at OFF. The -300 volt bias to the 400-cycle power supply is furnished at pin C of receptacle J1602 in the test equipment. Therefore, J1601 and J1602 must be connected to the power supply to prevent operation of the power amplifier tubes without grid bias.
- (2) Setting UPPER LIMIT RELAY switch S111 to OFF connects terminal 3 of upper limit relay K1611 to  $L_2$  and energizes the relay. With relay K1611 energized, application of a positive dc voltage (which may be obtained from 0-150VDC SIGNAL jack J112) to Eo SIGNAL UPPER jack J116 will cause limit release relay K1612 to operate. Presence of 115 volts ac between UP LOW RELAY VOLTS jack J117 and LINE 1 jack J118 indicates that K1612 has operated.



- (3) Similarly, setting LO LIMIT RELAY switch S112 to OFF operates lower limit relay K1610. Application of a positive voltage to Eo SIGNAL LOWER jack J115 will again operate relay K1612.

#### h. Altitude Computer Servo Amplifier.

- (1) R107 and R108 are substituted for the field winding of the computer servo motor and provide a load for power amplifier tubes V1606 and V1607.
- (2) Steps (2) and (3) of subparagraph g. above apply also to tests of the altitude computer servo amplifier.

#### i. Antenna Servo Amplifier.

- (1) R119 and R120 are substituted for the field winding of the azimuth generator and provide a load for power amplifier tubes V1507 and V1508. R117 and R118 replace the field winding of the elevation servo generator and receive +250 volts when servo relay K1544 is energized. This relay closes when the antenna servo amplifier is connected to the power supply group.

- (2) Setting EL CUT-OFF RELAY switch S110 at OFF grounds the cathode circuit of elevation power amplifiers V1518 and V1519 in the antenna servo amplifier. Setting the switch to ON removes the ground and cuts the tubes off.

- (3) Application of a 60-cycle, ac voltage to SIGNAL INPUT jack J113 excites the azimuth circuits of the antenna servo amplifier.

- (4) Application of a 60-cycle, ac voltage to MANUAL TRACK jack J114 excites the elevation circuits of the antenna servo amplifier.

j. RoHo Amplifier. R111 and R112 replace the Ro motor field. R113 and R114 are substituted for the Ho motor field.

k. Operating Voltages. The following units are only supplied operating voltages:

- (1) Range servo unit.
- (2) AFC unit.
- (3) Isolation amplifier.

## Section III

# MAINTENANCE

## 8. MAINTENANCE

a. The metallic air filters which are located at the rear of the cabinet should be cleaned when dirty.

b. The fan motor retains the lubricant applied at assembly and does not require additional lubrication.

c. When necessary, clean the cables with a clean cloth. Clean electrical contacts with a clean cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

CAUTION: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

## 9. DISASSEMBLY AND ASSEMBLY

a. General. The chassis removal and installation procedures apply to each chassis in the test equipment.

b. Removal. To remove the chassis from the test equipment, perform the following steps:

- (1) Loosen 24 captive screws on each compartment cover and pull the covers open.
- (2) Unscrew the knurled nut on each jack, and pull the associated jacks from the chassis.
- (3) Cut the tie wires that pass through the wing nuts.
- (4) Loosen the wing nuts and lockwashers that secure the two chassis locking collars to the chassis bracket. Lift the collars from the brackets, and permit the collars to fall away from the chassis.
- (5) Pull the chassis from the shelves in the test equipment.
- (6) To remove the amplifier loading chassis, unscrew 4 binding-head screws and disconnect 17 cable leads from terminal block E13 on the chassis (fig. 7).

c. Installation. To install each chassis in the test equipment reverse the order of the removal procedure.

d. Components. The locations of front-panel components are shown in figure 8. Figures 9 to 12 inclusive are electrical schematics of the power supply group and its components.

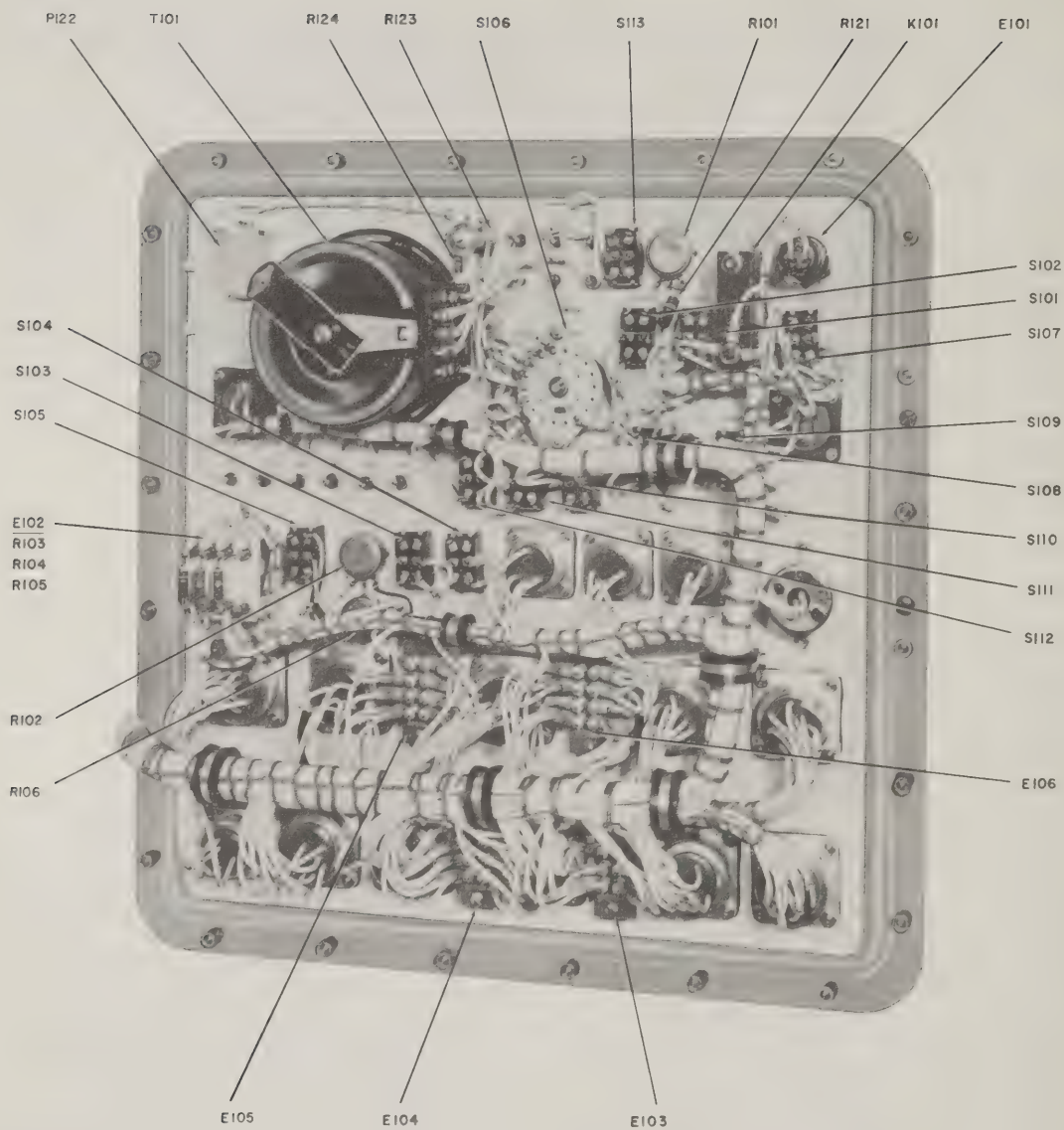


Figure 8. Control panel, rear, components.



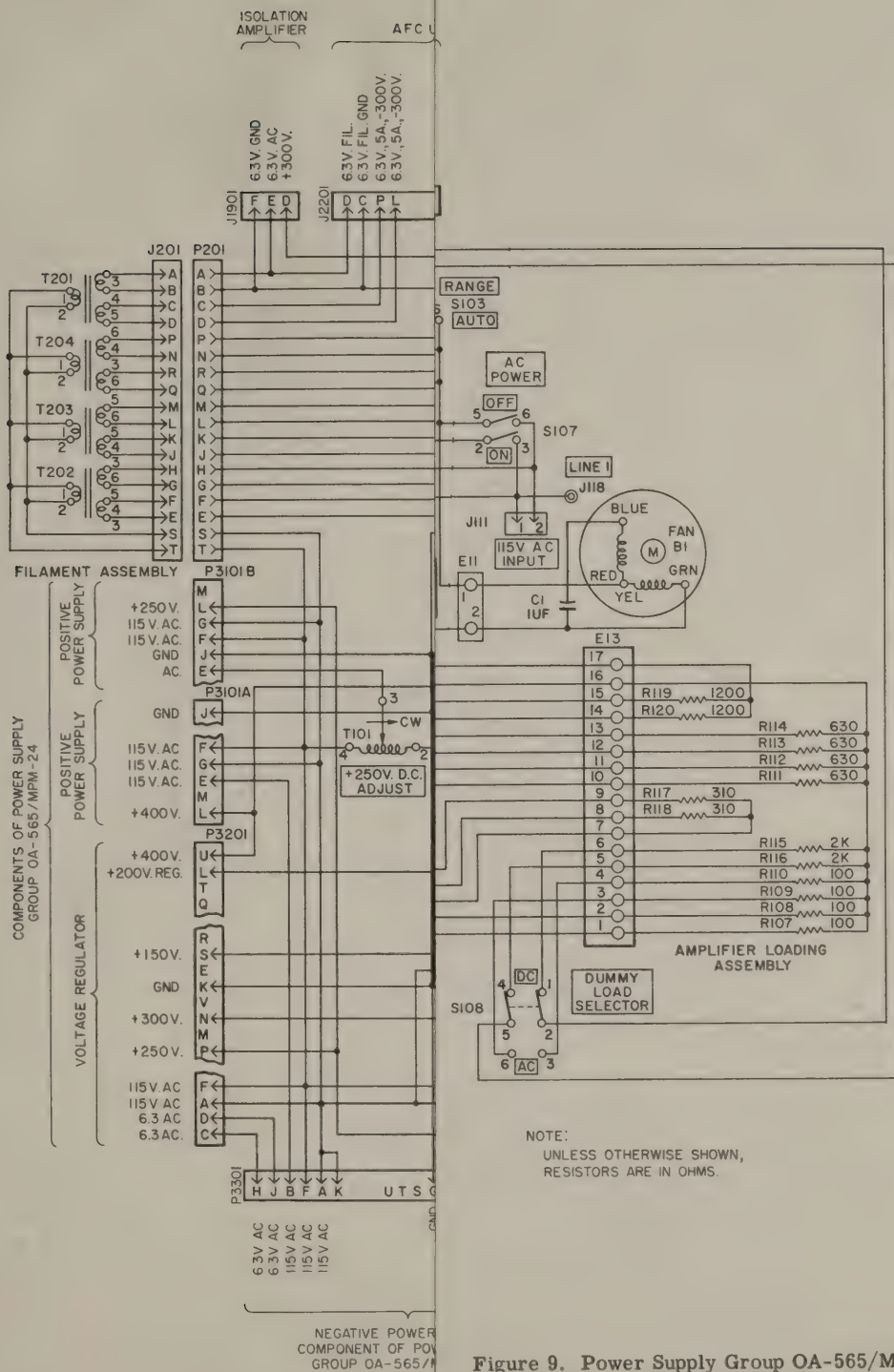


Figure 9. Power Supply Group OA-565/MPM-24, schematic diagram.

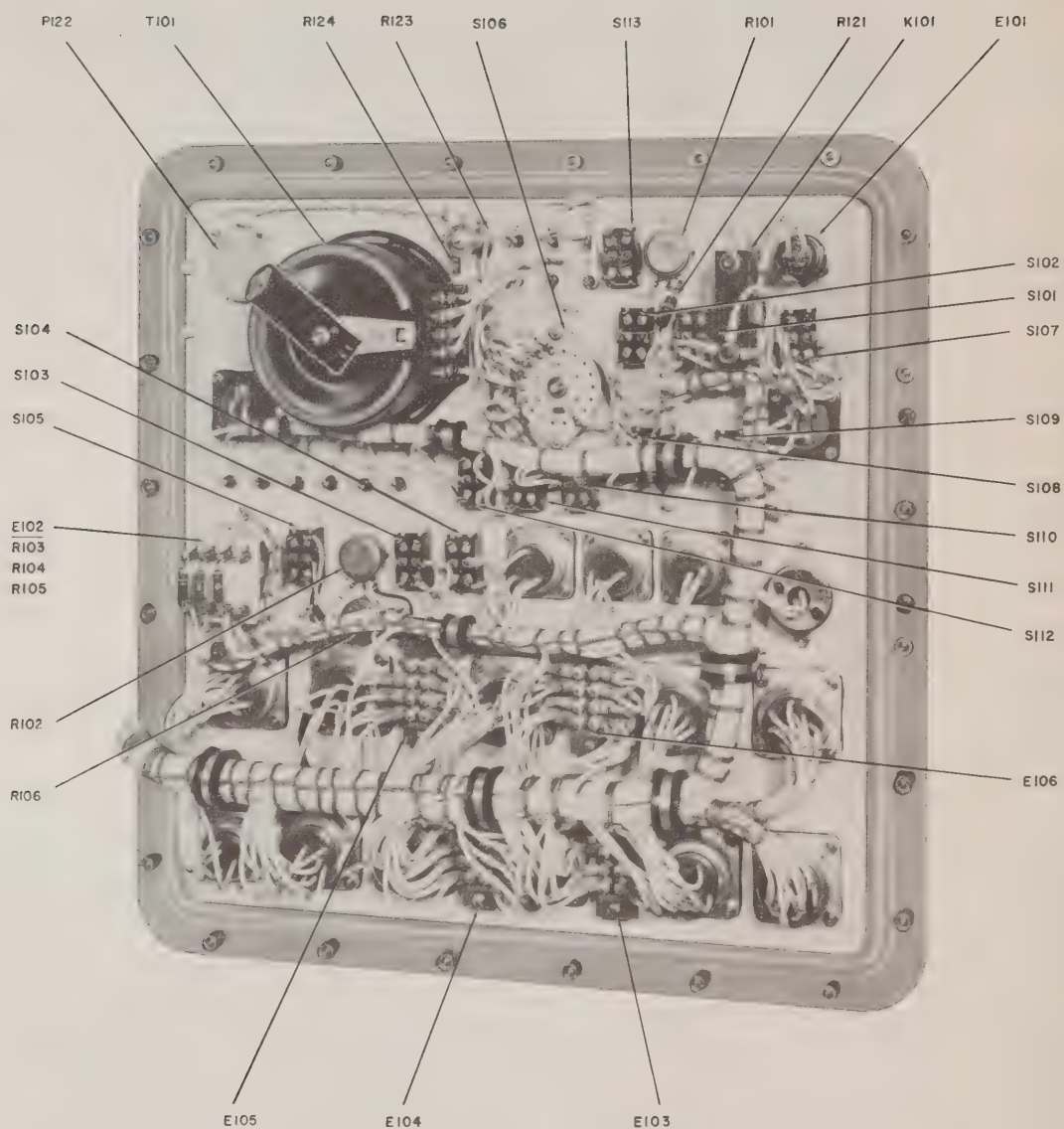


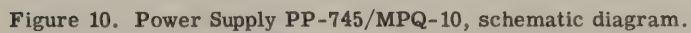
Figure 8. Control panel, rear, components.











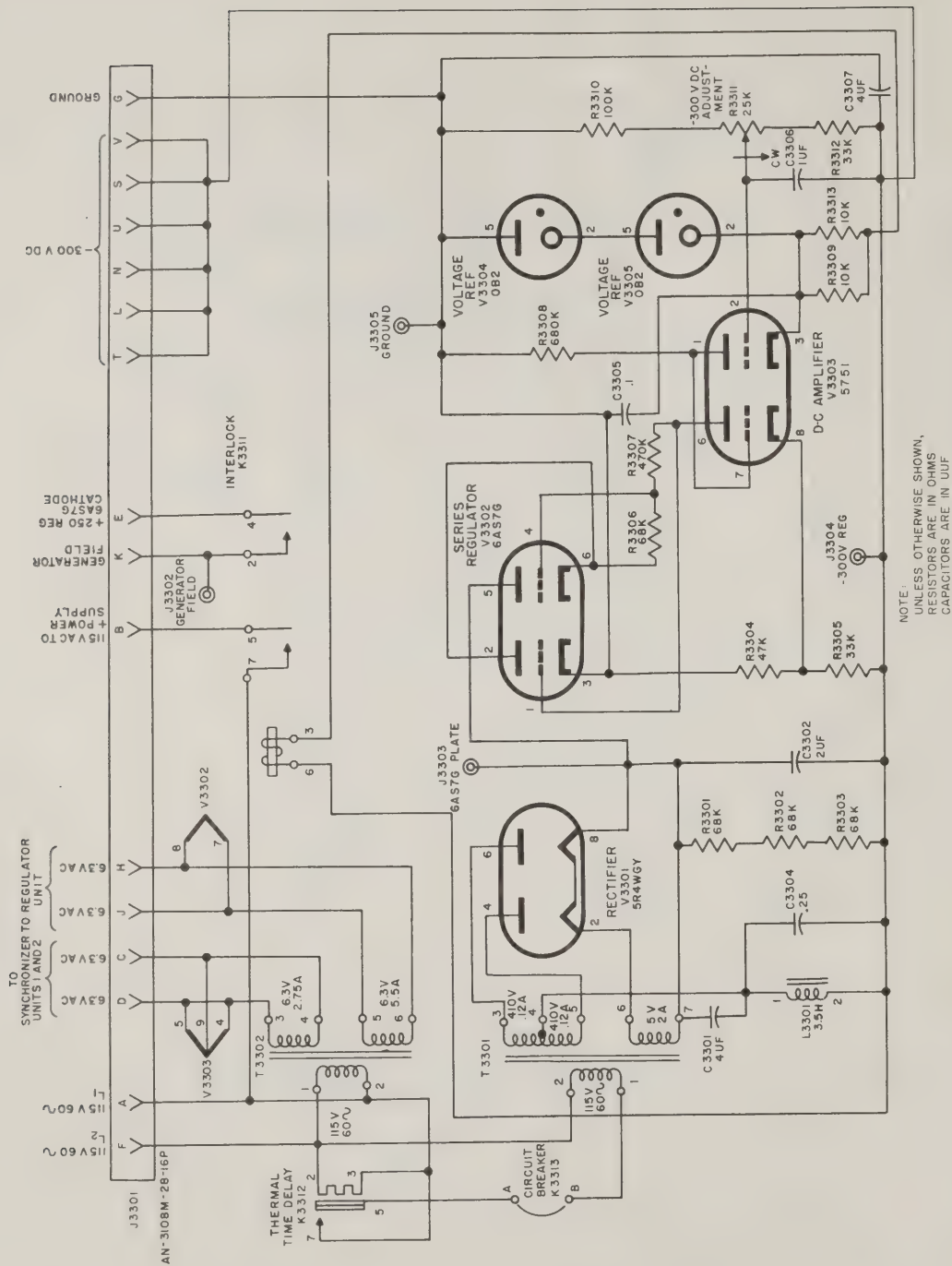


Figure 11. Power Supply PP-746/MPQ-10, schematic diagram.









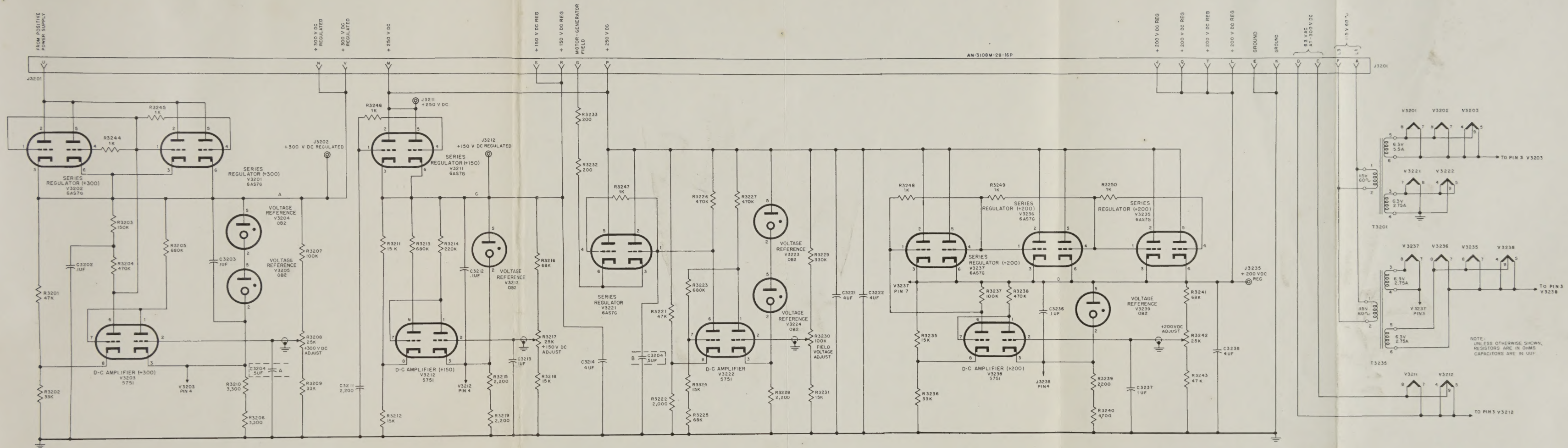


Figure 12. Voltage Regulator CN-167/MPQ-10, schematic diagram.

